TELEDYNE LECROY
Everywhereyoulook™

# Eclipse UniPro/UFS
## Protocol Analyzer/Exerciser Product Family


## Key Features and Benefits

**Analyzer**

- Trace Validation™
- Multiple views
  - Link widths x1-x2
  - UniPro and UFS Decoding
  - Simple and Advanced Triggering
  - Pre-Capture Filtering
  - UFS Data Truncation

**Exerciser**

- Full UniPro stack in HW
  - Full protocol emulation
  - Error insertion
  - Extended stress test capabilities

**CTS**

- Conformance/compliance
  - UFSA-certified for the UFSA Compliance Test Matrix v1.3.
  - Corner case, margin and stress testing
  - Custom test case creation

**System**

- SMA probing
- Solder-down probing
- 40 Gbps Thunderbolt3 connection

**Teledyne LeCroy is a contributing company to the development of the UniPro 1.61 and 1.8 specs and Conformance Test Specs, and a member of the JEDEC J64 Embedded Memory Storage and Removable Memory Card committee. UniPro/UFS analysis tools feature full decoding of the UniPro and UFS protocol layers, with unique Events views of low level packet information and raw symbols. The Eclipse product family offers many unique features such as; Trace Validation expert system analysis, UniPro and UFS protocol generation and exerciser capability, traffic builders for creation of individual custom exerciser scripts, and exceptional flexibility, with remote upgrade to HS-HG4B and/or exerciser capability via SW license update.**

**The Eclipse T42 and Eclipse T32 Protocol Analyzers are entry level UniPro/UFS protocol analyzers with robust capabilities for debugging everyday issues.**

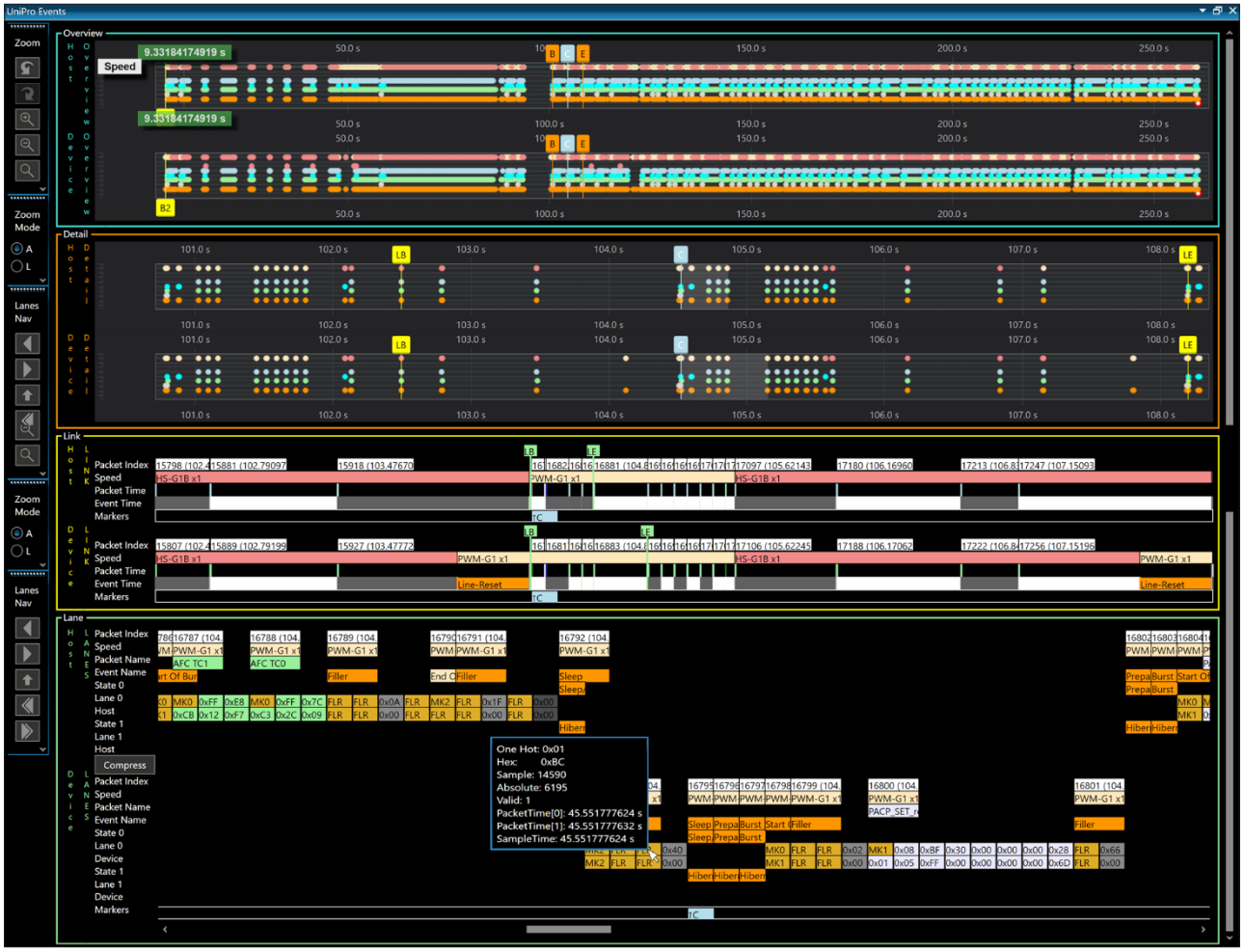
- The **Eclipse T42 Protocol Analyzer** is an entry level protocol analyzer that can capture x2 links of UniPro/UFS at speeds up to HS-Gear4B. It supports M-PHY v4.1, MIPI UniPro v1.81 and UFS3.0. The Eclipse T42 can be upgraded to the advance feature set of the Eclipse M42x Protocol Analyzer.
- The **Eclipse T32 Protocol Analyzer** is similar to the Eclipse T42 but limited capturing traffic at up to HS-Gear3. The Eclipse T32 can be upgraded to HS-Gear4B, as well as the advanced analysis features of the Eclipse M32x/42x Protocol Analyzer.

**The Eclipse M42x and Eclipse M32x Protocol Analyzer/Exercisers are the established industry standard with powerful protocol analysis and traffic generation capabilities with unprecedented flexibility.**

- The **Eclipse M42x Protocol Analyzer/Exerciser** is an advanced Protocol Analyzer/Exerciser that can capture or generate x2 links of UniPro/UFS traffic. The Eclipse M42x can be configured as an analyzer only, or as an analyzer/exerciser. When configured as an exerciser, or traffic generator, the Eclipse M42x can generate up to x2 link traffic while simultaneously capturing the response traffic from the DUT. The Compliance/Conformance Test Suites (CTS) included with the Eclipse M42x Protocol Analyzer/Exerciser will verify and validate the relevant CTS specs for UniPro 1.8 and UFS 3.0.
- The **Eclipse M32x Protocol Analyzer/Exerciser** is similar to the Eclipse M42x protocol analyzer/exerciser but limited to HS Gear3 for data capture and traffic generation. It supports M-PHY v4.1, MIPI UniPro v1.81 and UFS3.0. at up to HS-Gear3. The Compliance/Conformance Test Suites (CTS) included with the Eclipse M32x Protocol Analyzer/Exerciser can verify and validate UFS2.1 to the JEDS224A CTS and UniPro to the UniPro v1.61 CTS v1.1. The Eclipse M32x can be upgraded to support HS-G4B.

## Events Views

UniPro and UFS Events views complement the Packet List windows, showing all events on the bus in both directions in one single snapshot linked to the selected packet and bookmarks. Zooming in on any event or series of events will show the time-aligned packet data and expanded packet information in detail down to raw trace K-Code information, including the One Hot and Hex values.

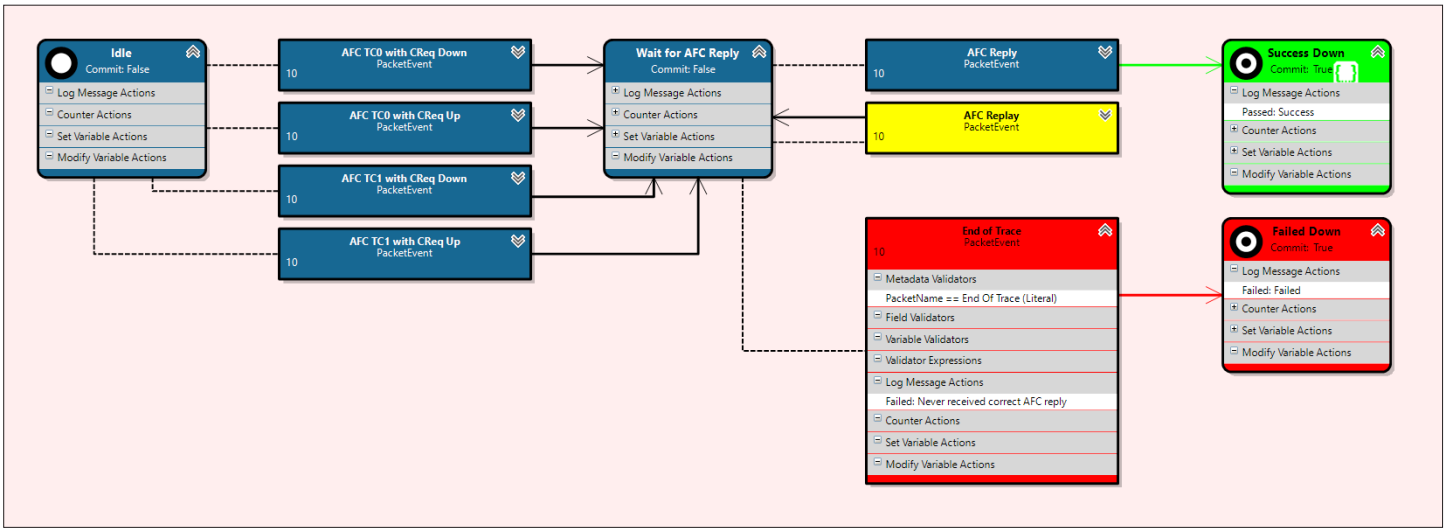



*UniPro Events View*

## Trace Validation

Trace Validation identifies transactions on the link by analyzing millions of packets in a trace capture, then evaluates the complete protocol sequences and individual packets for conformance to the specification.

With Trace Validation, complex transactions such as power mode changes, Link Startup Sequence and NAC/Replay events can be automatically analyzed and easily debugged. Trace Validation finds the problems an engineer can't.




*Trace Validation state machine model*

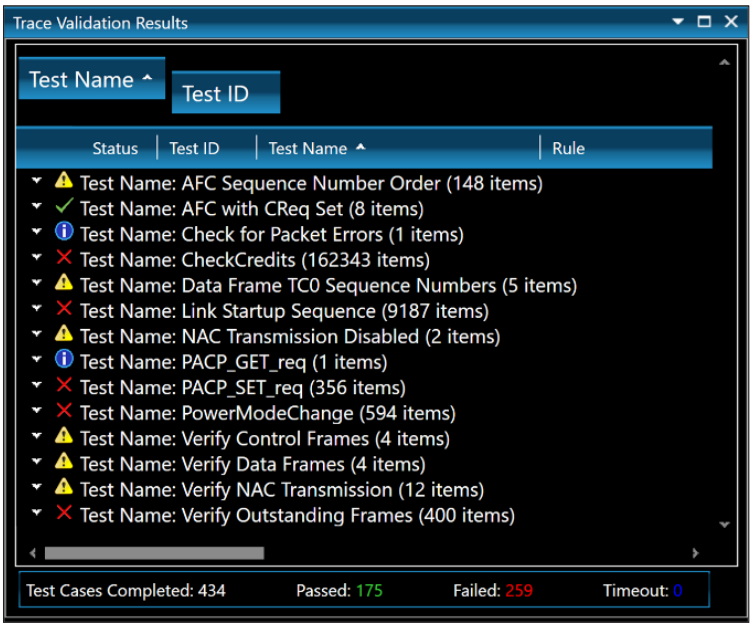
Trace Validation results are flagged as follows:

**Failure** ✕ and **Warning** ⚠ status flags

- A Failure is a transaction or packet does not meet a defined primary rule. This rule may be defined by the JEDEC JESD224 CTS, UniPro v1.1 CTS or by the user.
- A Warning is a transaction or packet does not meet a defined secondary rule. This rule may be defined by the JEDEC JESD220x spec, UniPro v1.61 spec or by the user.

**Pass** ✓ and **Info** ⓘ and **Debug** 🔍 status flags

- Any transaction or packet that conforms the rule set is marked as Pass
- Any packets not inspected due to run conditions are highlighted and explained with the Info flag
- Information on state machine execution of an inspection rule is provided with Debug messages

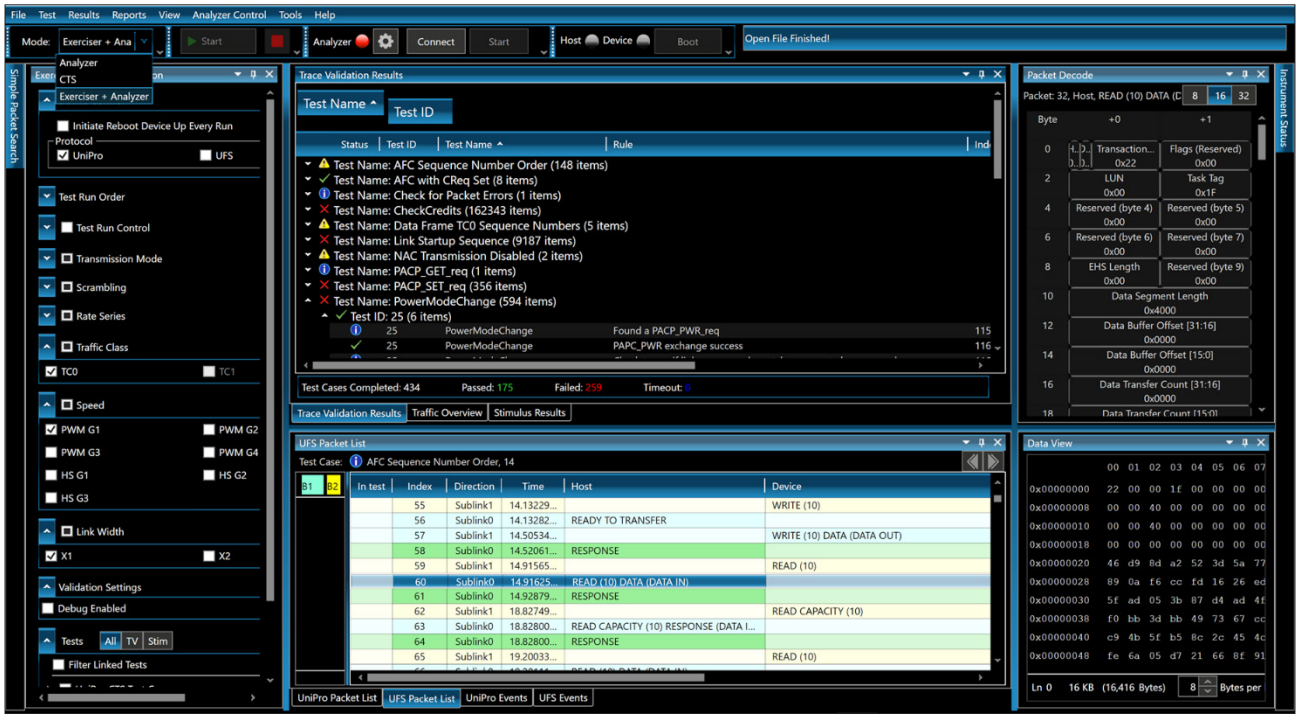



*Trace Validation pass/fail messages*

## Compliance/Conformance Verification

The Eclipse M32x and Eclipse M42x advanced Protocol Analyzer/Exercisers can execute UniPro and UFS Compliance Test Specification (CTS) tests, using Trace Validation to verify that the resulting protocol sequences and packets conform to the CTS. The UniPro v1.1 CTS and JEDEC JESD224A CTS are currently supported. The updated UniPro 1.8 and UFS 3.0 CTS specs will be supported once released from the respective special interest groups.

Extensive reporting and analysis tools include reports by test parameters – status, individual tests, or test rules, and within tests by packet characteristics such as packet number, byte, speed, link, etc. Summary and full reports and pass/fail reports are also provided.




*Pass/fail analysis using Trace Validation Results*

## Stimulus with Full UniPro Stack in HW

The Eclipse M32x and Eclipse M42x utilize a full UniPro embedded stack in the hardware so the user can:

- Create specific traffic on the link
- Put the DUT into known states
- Insert errors into the UniPro or UFS traffic stream
- Create custom stimulus sequences to execute complex events, e.g. NAC Conditions or Power Mode Changes
- Automate with Run Control for stress testing

## UniPro/UFS Exerciser

The exerciser capability included with the Eclipse M32x and Eclispe M42x Protocol Analzyer/Exerciser can be used for compliance and conformance testing and for stress, margin and corner case automated testing:

- **UFS device CTS compliance**
  - Verifies test cases defined in JESD224 for JESD220B.
  - Verifies test cases defined in JESD224A for JESD220B, JESD220C and JESD220-2.

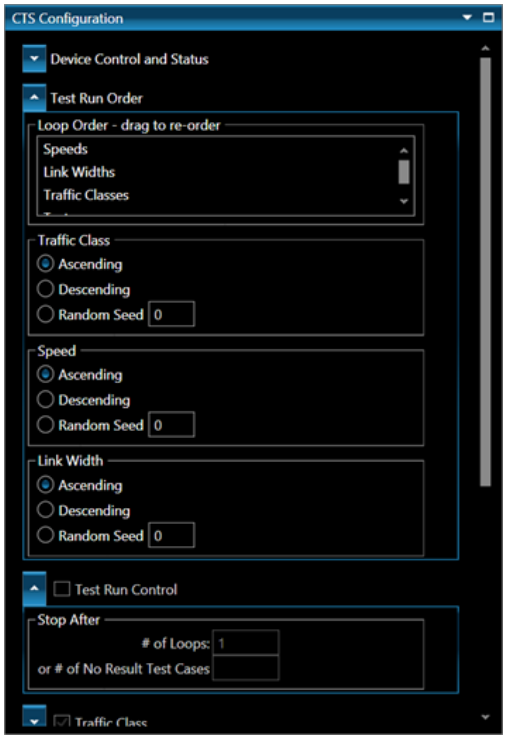
| Status | Test Name | LUN | Link Width | Speed |
|---|---|---|---|---|
| ✓ | 7.1.1 UFS Inquiry 01 | 0 | 1 | PWM |
| ✓ | 7.1.1 UFS Inquiry 01 | 176 | 1 | PWM |
| ✓ | 7.1.1 UFS Inquiry 01 | 129 | 1 | PWM |
| ✓ | 7.1.1 UFS Inquiry 01 | 208 | 1 | PWM |
| ✓ | 7.1.2 UFS Inquiry 02 | 0 | 1 | PWM |
| ✓ | 7.1.2 UFS Inquiry 02 | 176 | 1 | PWM |
| ✓ | 7.1.2 UFS Inquiry 02 | 129 | 1 | PWM |

  - New test cases for the updated UFS3.0 JEDEC JESD224x CTS will be added in the future to verify JESD220D and JESD220-2A

- **UniPro CTS conformance**
  - Verifies test cases as defined in the v1.1 CTS.
  - Method of Implementation (MOI) approved by the MIPI Alliance Test Work Group
  - New test cases for the updated MIPI UniPro v1.8 CTS will be added in the future

- **UniPro and UFS device spec conformance**
  - Trace Validation engine evaluates UniPro and UFS protocol sequences, “shall” statements and logical requirements

- **Custom test cases**
  - Create stimulus and Trace Validation analysis test cases
  - Executable with Run Control
  - Build tests from scratch, or use existing CTS and debug tests cases as a starting point




- **Stress Testing**
  - Execute any loop order by Speed, Link widths, LUNs or individual test cases
  - Each category can be run ascending, descending, or random seed order
  - Stop after a specified number of test case configuration loops or No Result Test Cases have occurred

- **Group, filter and summarize test results by test parameters – status, individual tests, or test rules**

- **Summary reports and full file export**

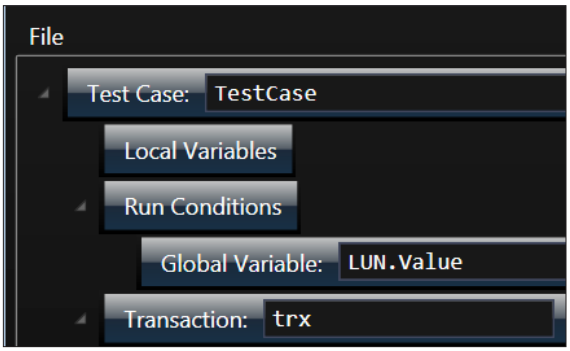
## Custom Test Case Builders

The Eclipse m32x and M42x include custom test case script “Builders” that can be used to create unique stimulus and analysis tests. Stimulus tests created with Custom test Builders can be run with test executive for automated margin, corner case and stress testing.

Custom tests can be created from scratch, or they can be based on the pre-defined tests provided in the Eclipse software library.

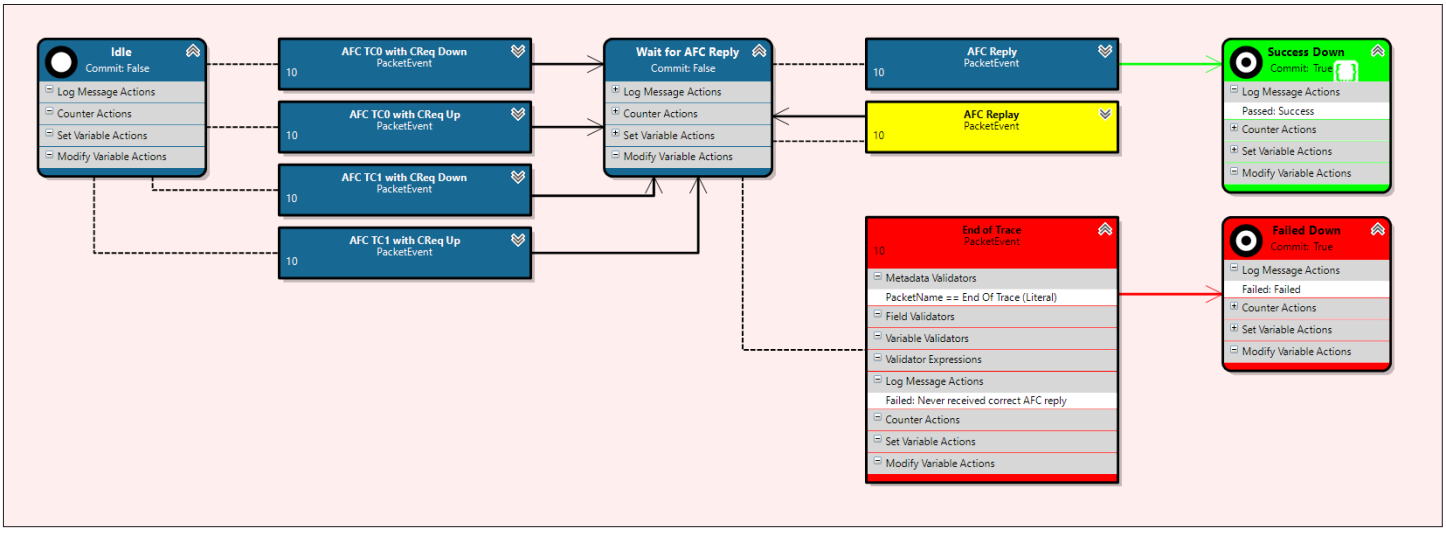
Stimulus capabilities available with custom Stimulus Builders include:

- Put DUT into known states
- Create specific link traffic
- Insert errors into the traffic stream
- Create stimulus sequences to execute complex events, e.g. NAC Conditions or Power Mode Changes
- Automate with Run Control for stress testing




Analysis capabilities available with custom Trace Validation Builder include:

- Easy-to-use graphical user interface
- Analyze traffic on any trace file captured “sniffer” style from any bi-directional link
- Use complex state machine logic to verify all trace attributes
- Log messages and attributes with Failure, Warning, Pass, Info and Debug flags



## Specifications

Product specifications are subject to change without notice.

### Eclipse T32 and Eclipse M32x

Supports UFS 3.0, MIPI UniPro v1.8 and M-PHY v4.1 HS-G3 and are HS-G4B ready.

By ordering an upgrade option an Eclipse T32 Protocol Analyzer, Eclipse M32x Analyzer/Exerciser can be upgraded to support HS-G4B.

| Eclipse T32 (M-PHY Type-I) | |
|---|---|
| Protocols Supported | M-PHY Type-I |
| Host Machine Minimum Requirements | Microsoft Windows 10 64-bit operating system; Intel® Core™ i7 or i9 processor or equivalent; 32 GB RAM recommended, 16 GB minimum; NVMe solid state drive with 500GB free space recommended, 256GB minimum free space; Thunderbolt 3 enabled type-c connector is required |
| Software Requirements | Windows 7 or 10 64-bit operating system; Microsoft SQL Server 2014 or later; Microsoft Visual Studio 2013 Shell (Isolated); Teledyne LeCroy software and firmware version 1.6.4.[xxx] or later |
| Speeds | High-Speed (HS) Gear1, Gear2, and Gear3, Rate Series A/B; Low-speed Pulse-width Modulation (PWM) Gear1 to Gear4 in Type-I LS implementation |
| Link Width | x1 and x2 |
| Trace Capture Memory Depth | 8 GB |
| Probing Options | SMP and solder-down included, with probe pod optional |
| Dimensions (W x H x D) | 12.7” x 2.7” x 9.9”, 32.4cm x 6.9cm x 25.0cm (Bumper adds 0.21”, or 5mm to the height and 0.28” or 7mm to the width) |
| Weight | 5.9lbs (2.7kg) |

| Eclipse M32x Exerciser (M-PHY Type-I) | |
|---|---|
| Protocols Supported | M-PHY Type-I |
| Host Machine Minimum Requirements | Microsoft Windows 10 64-bit operating system; Intel® Core™ i7 or i9 processor or equivalent; 32 GB RAM recommended, 16 GB minimum; NVMe solid state drive with 500GB free space recommended, 256GB minimum free space; Thunderbolt 3 enabled type-c connector is required |
| Software Requirements | Windows 7 or 10 64-bit operating system; Microsoft SQL Server 2014 or later; Microsoft Visual Studio 2013 Shell (Isolated); Teledyne LeCroy software and firmware version 1.6.4.[xxx] or later |
| Speeds | High-Speed (HS) Gear1, Gear2, and Gear3, Rate Series A/B; Low-speed Pulse-width Modulation (PWM) Gear1 to Gear4 in Type-I LS implementation |
| Link Width | x1 and x2 |
| Trace Capture Memory Depth | 8 GB, shared between exerciser and analyzer |
| Probing Options | SMP and solder-down available, with probe pod optional; SMP connections are required for exerciser functionality |
| Dimensions (W x H x D) | 12.7” x 2.7” x 9.9”, 32.4cm x 6.9cm x 25.0cm (Bumper adds 0.21”, or 5mm to the height and 0.28” or 7mm to the width) |
| Weight | 5.9lbs (2.7kg) |
| Compliance CTS Support | UFS 2.x embedded and card, with JEDEC CTS v1.0 (JESD224) and v1.1 (JESD224A), UniPro 1.6x, with MIPI CTS v1.1 |

### Available Upgrades

- Analyzer upgrade to HS-G4B
- Analyzer to Exerciser upgrade for MIPI M-PHY v3.1 HS-G3 (Eclipse M32x only)
- Exerciser/Analyzer upgrade to HS-G4B (Eclipse M32x only)

### Orderable Accessories

- Enhanced Connectivity Kit – includes Thunderbolt3 6ft/2m 40Gbps active cable and cable retention device
- Solder-down probe – HS-G3 and HS-G4B x2 bundle (included with the Eclipse T series)
- Solder-down probe pod - HS-G4B solder-down probe pod for superior probing in demanding test environments with less than optimal signal integrity

### Recommended Accessories

- Mini-Circuits ZFRSC-183-S+ DC-18 GHz power splitter
- Centric RF C581-086-12 SMA to SMA cables, ≥18GHz, 12 inches length
- Thunderbolt3 Cable, 6ft/2m 20Gbps cable

### Eclipse T42 and Eclipse M42x

Supports UFS3.0, MIPI UniPro v1.8 and M-PHY v4.1 up to HS-G4B.

| Eclipse T42 (M-PHY Type-I) | |
|---|---|
| Protocols Supported | M-PHY Type-I |
| Host Machine Minimum Requirements | Microsoft Windows 10 64-bit operating system; Intel® Core™ i7 or i9 processor or equivalent; 32 GB RAM recommended, 16 GB minimum; NVMe solid state drive with 500GB free space recommended, 256GB minimum free space; Thunderbolt 3 enabled type-c connector is required |
| Software Requirements | Windows 7 or 10 64-bit operating system; Microsoft SQL Server 2014 or later; Microsoft Visual Studio 2013 Shell (Isolated); Teledyne LeCroy software and firmware version 1.6.4.[xxx] or later |
| Speeds | High-Speed (HS) Gear1, Gear2, Gear3, and Gear 4, Rate Series A/B; Low-speed Pulse-width Modulation (PWM) Gear1 to Gear4 in Type-I LS implementation |
| Link Width | x1 and x2 |
| Trace Capture Memory Depth | 8 GB |
| Probing Options | SMP and solder-down included, with probe pod optional |
| Dimensions (W x H x D) | 12.7” x 2.7” x 9.9”, 32.4cm x 6.9cm x 25.0cm (Bumper adds 0.21”, or 5mm to the height and 0.28” or 7mm to the width) |
| Weight | 5.9lbs (2.7kg) |

| Eclipse M42x Exerciser (M-PHY Type-I) | |
|---|---|
| Protocols Supported | M-PHY Type-I |
| Host Machine Minimum Requirements | Microsoft Windows 10 64-bit operating system; Intel® Core™ i7 or i9 processor or equivalent; 32 GB RAM recommended, 16 GB minimum; NVMe solid state drive with 500GB free space recommended, 256GB minimum free space; Thunderbolt 3 enabled type-c connector is required |
| Software Requirements | Windows 7 or 10 64-bit operating system; Microsoft SQL Server 2014 or later; Microsoft Visual Studio 2013 Shell (Isolated); Teledyne LeCroy software and firmware version 1.6.4.[xxx] or later |
| Speeds | High-Speed (HS) Gear1, Gear2, Gear3 A/B, and Gear 4, Rate Series A/B; Low-speed Pulse-width Modulation (PWM) Gear1 to Gear4 in Type-I LS implementation |
| Link Width | x1 and x2 |
| Trace Capture Memory Depth | 8 GB, shared between exerciser and analyzer |
| Probing Options | SMA and solder-down available, with optional probe pod; SMA required for exerciser functionality |
| Dimensions (W x H x D) | 12.7” x 2.7” x 9.9”, 32.4cm x 6.9cm x 25.0cm (Bumper adds 0.21”, or 5mm to the height and 0.28” or 7mm to the width) |
| Weight | 5.9lbs (2.7kg) |
| Compliance CTS Support | UFS 2.x, UFS 3.0 planned |
| Conformance Support | UniPro 1.6x, UniPro 1.8 |

### Available Upgrades

- Analyzer to Exerciser upgrade for MIPI M-PHY v4.1 HS-G4B (Eclipse only)

### Orderable Accessories

- Enhanced Connectivity Kit – includes Thunderbolt3 6ft/2m 40Gbps active cable and cable retention device
- Solder-down probe - HS-G3 and HS-G4B x2 bundle (included with the Raptor series)
- Solder-down probe pod - HS-G4B solder-down probe pod for superior probing in demanding test environments with less than optimal signal integrity

### Recommended Accessories

- Mini-Circuits ZFRSC-183-S+ DC-18 GHz power splitter
- Centric RF C581-086-12 SMA to SMA cables, ≥18GHz, 12 inches length
- Thunderbolt3 Cable, 6ft/2m 20Gbps cable

| DUT Requirements to sync analyzer to a UniPro link | | |
|---|---|---|
| **Attribute** | **Spec** | **Typical** |
| TxHsG1SyncLength (0x1552) | 256 Symbols, 0x48 Capability value | 64 Symbols, 0x46 Capability value |
| TxHsG2SyncLength (0x1555) | 256 Symbols, 0x48 Capability value | 64 Symbols, 0x46 Capability value |
| TxHsG3SyncLength (0x1556) | 256 Symbols, 0x48 Capability value | 64 Symbols, 0x46 Capability value |
| TxHsG4SyncLength (0x15D0) | 256 Symbols, 0x48 Capability value | 64 Symbols, 0x46 Capability value |
| TxHsG1PrepareLength(0x1553) | 0xA Capability value | 0x3 Capability value |
| TxHsG2PrepareLength(0x1554) | 0xA Capability value | 0x3 Capability value |
| TxHsG3PrepareLength(0x1557) | 0xA Capability value | 0x3 Capability value |
| TxHsG4PrepareLength(0x15D1) | 0xA Capability value | 0x3 Capability value |
| RxLsPrepareLength | 0xA Capability value | 0x1 Capability value |
| RxPwmBurstClosureLength | 0x1F Capability value | 0x1 Capability value |
| To sync to existing link | one Start of Burst | one Start of Burst |

The typical settings assume configuration with 50/50 splitter and recommended cables. Actual performance may vary depending on the probing and the signal integrity of the DUT.

**DUT Requirements to establish a UniPro link with the Eclipse exerciser**

- The device must execute a UniPro 1.61 or 1.8 compliant Link Startup Sequence.

## Compliance

**Export Control Classification Number (ECCN): 3B992 b.4.b.1, No License Required**

**US Export Schedule-B harmonization code: 9030.89.0100**

**Safety, Compliance and Environmental Information**

Conforms to UL STD 60950-1

Certified to CSA STD C22.2 # 60950-1

ETL Control Number: [xxxxxxx]

Complies with IEC 60950-1:2005 (Second Edition) + Am 1:2009 + Am 2:2013 Manufacturer's Declaration of Conformity to European Directive 2014/35/EU (Low Voltage Directive)

Compliant with Radiated Emissions (CISPR 32:2012), 7 Power Port Conducted Emissions (CISPR 32:2012), 8 Harmonics (IEC 61000-3-2:2014), 9 Flicker, (IEC 61000-3-3:2013), 10 Electro-Static Discharge Immunity Test (IEC 61000-4-2:2008), 11 Radiated, Radio-Frequency, Electromagnetic Immunity (IEC 61000-4-3:2010), 12 Electrical Fast Transient/Burst Immunity Test (IEC 61000-4-4:2012), 13 Immunity to Surges (IEC 61000-4-5:2014), 14 Conducted, Radio-Frequency, Electromagnetic Immunity Test (IEC 61000-4-6:2013), 15 Voltage Dips/Interruptions Immunity Test (IEC 61000-4-11:2004)

Compliant with the European Union directive 2002/95/EC and 2011/65/EU on the Restriction of the use of certain hazardous substances in electrical and electronic equipment and components (RoHS).

## Ordering Information

| Product Description | Product Code |
|---|---|
| Eclipse T32 | MPHY-T32-TAA-X |
| Eclipse T42 | MPHY-T42-TAA-X |
| Eclipse M32x Analyzer | MPHY-M32X-TAA-X |
| Eclipse M42x Analyzer | MPHY-M42X-TAA-X |
| Eclipse M32x Analyzer/Exerciser | MPHY-M32X-TZA-X |
| Eclipse M42x Analyzer/Exerciser | MPHY-M42X-TZA-X |
| Eclipse T32 Pro Upgrade | MPHY-T32-PRO-U |
| Eclipse T42 Pro Upgrade | MPHY-T42-PRO-U |
| Eclipse T32 Upgrade to Gear4 | MPHY-T32-42-X-U |
| M-PHY Gear4 Multi-lead Pod | MPHY-MP4-001-X |
| M-PHY Gear4 Multi-lead solder down Tip | MPHY-ML4-AC001-X |
| M-PHY Gear 4 Multi-lead Cable with Pwr | MPHY-MLP-AC004-X |
| M-PHY Gear4 Multi-lead x1 Bundle | MPHY-M42-ML001-B |
| M-PHY Gear4 Multi-lead x2 Bundle | MPHY-M42-ML002-B |
| Eclipse Advanced Thunderbolt connectivity kit | MPHY-M42-ECK-X |

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